Clinical Applications of Fetal Cardiac Electromechanical Intervals.

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General relationships

In the human fetus PEP duration increases with fetal age (1,5-8). Shortening of PEP after 40 weeks' gestational age was observed in one study (1), but not in others (6,7). The range of individual values observed in normal fetuses has been wide (Fig. 1), although the mean values found in the several studies have been in good agreement. An inverse relationship between PEP and fetal heart rate (FHR) has been both claimed (1,7) and denied(5). VET was found to vary inversely with FHR above approximately 115 beats/min, but below this level no further prolongation of VET occurred (5). PEP/VET increases with fetal age (8).

Relation to FHR patterns.

The PEP has been found to increase during variable decelerations (2-4,9), as would be expected from the circulatory changes (increased blood pressure, decreased cardiac filling). With late deceleration shortening of the PEP (2-4,9), attributed to adrenergic stimulation, and lengthening of VET (9) have been observed. PEP duration increases during FHR accelerations whether these are associated with fetal movements or uterine contractions (2,4).

Relationship with fetal condition

Both abnormally short (4,7) and abnormally long (6) PEP durations have been measured antepartum in fetuses which exhibited other evidence of distress before or during labor, or neonatal morbidity. This discrepancy may have resulted from differences in the stage at which the measurements were made in the course of fetal deterioration. Fig. 2 shows serial measurements of PEP in 6 fetuses which developed FHR decelerations ante

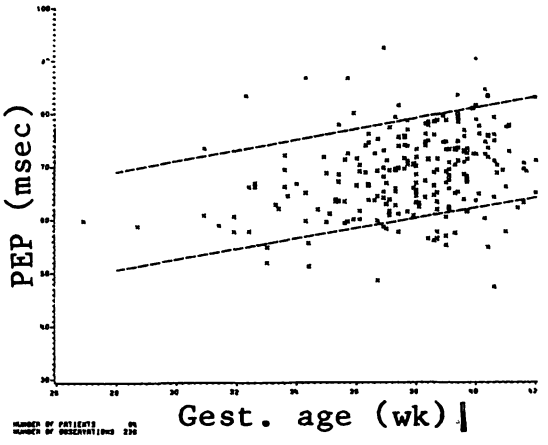

Fig.1. PEP values in normal fetuses. 10th and 90th percentiles are indicated.

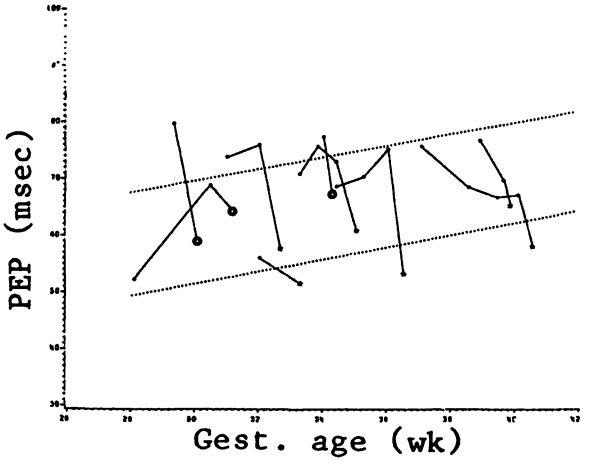

Fig. 2. Serial values of PEP in 6 fetuses which developed FHR decelerations and 3 which died in utero. For symbols, see text.

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partum (lines ending in stars) and 3 others which died in utero (circled stars). In 8 of the 9 cases one or more relatively long PEP values was recorded before fetal death or the onset of distress, but in only 4 cases was the upper warning limit exceeded. PEP subsequently shortened in all cases, but in only 3 did it fall below the lower warning limit. The PEP values within 1 week before fetal death were well within the normal range, although more frequent measurements might have shown further shortening. Both shortening and prolongation of PEP were found in association with fetal acidemia during labor (1). Also, both shortening (3,4) and prolongation (4) of the PEP in labor have been observed in severely asphyxiated fetuses.

Conclusions

Measurement of the cardiac electromechanical intervals has been proposed as a supplemental means of assessing fetal condition when the FHR pattern and/or other indicators are equivocal. The changes in PEP during fetal distress are too inconsistent for this purpose, especially in view of the wide range of values found in normal fetuses. PEP/VET is a better index of myocardial performance in adults than either of its components alone, and PEP/VET has been inadequately investigated in the fetus. Practically, the point of actual or incipient myocardial failure is a rather late time at which to diagnose fetal deterioration. The cardiac electromechanical intervals would seem to be better suited for investigation of fetal cardiovascular pathophysiology, in combination with other evolving techniques such as ultrasonic measurements of blood flow, than for clinical diagnoses.

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